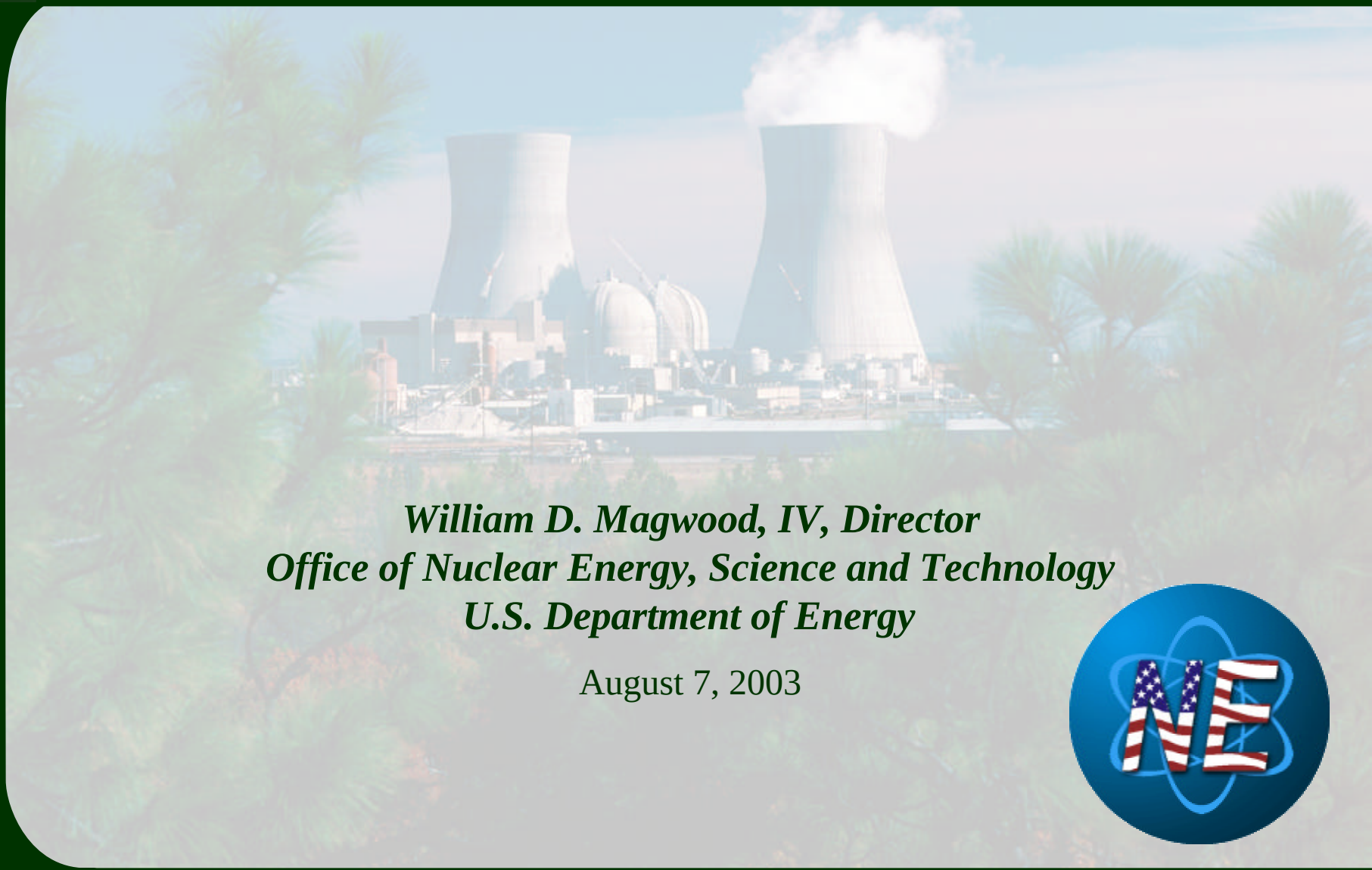
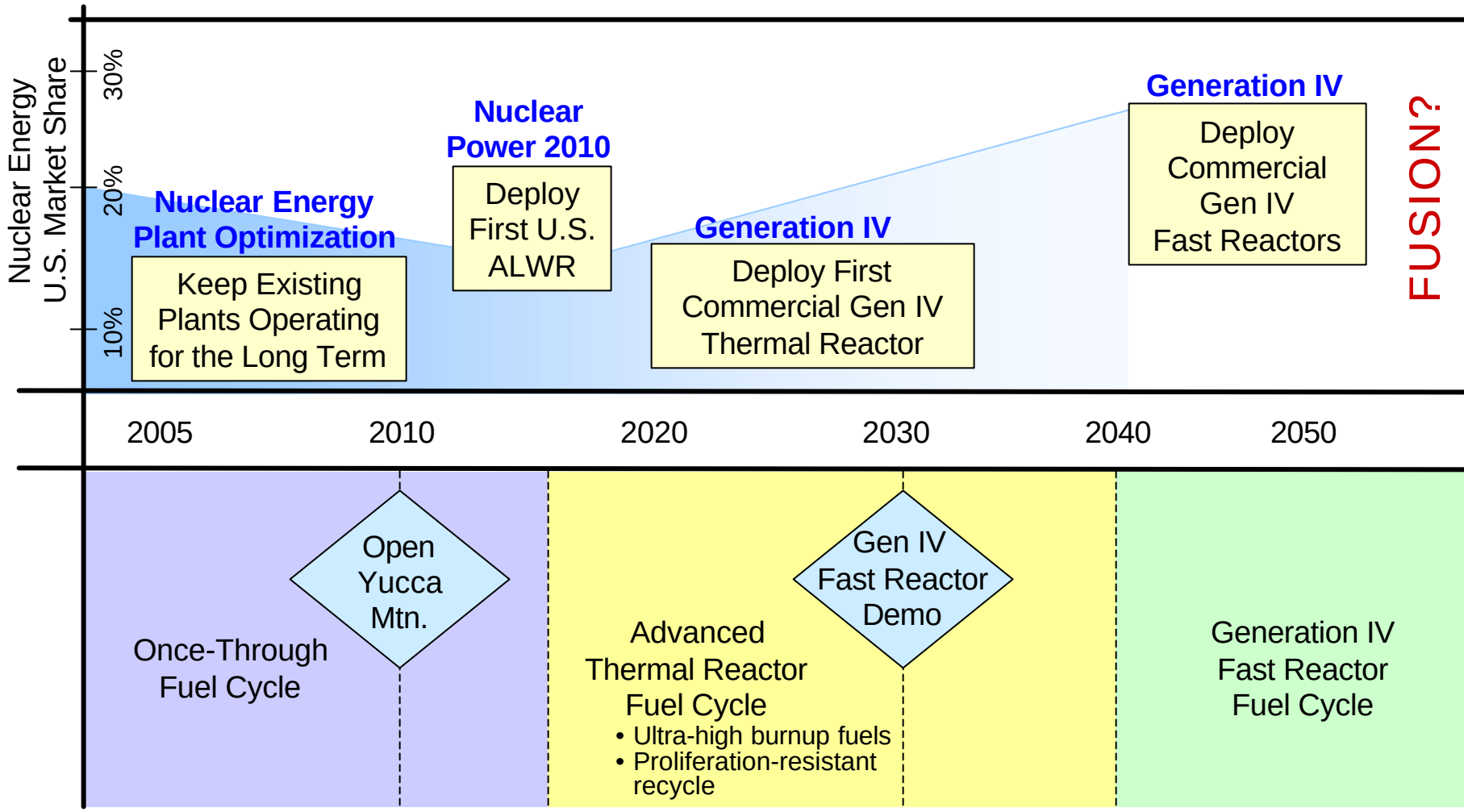
Idaho National Laboratory's Role in The Nuclear Energy Future



William D. Magwood, IV, Director
Office of Nuclear Energy, Science and Technology
U.S. Department of Energy

August 7, 2003

A Long-Term Strategy for Nuclear Energy



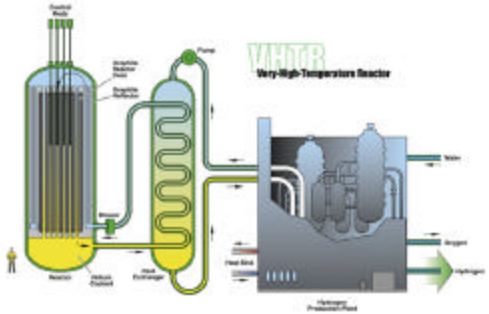
Generation IV Nuclear Energy Systems:
Nuclear Power for a New Century

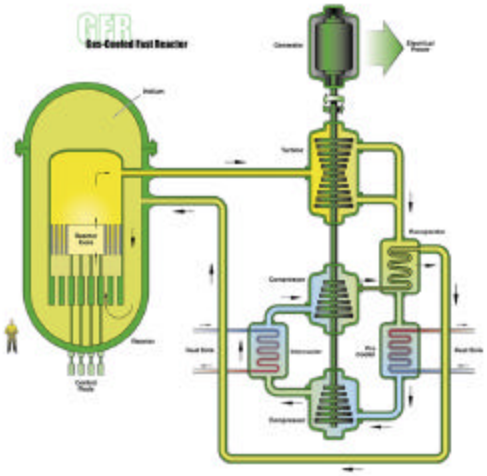
Generation IV International Forum established in January 2000 to develop:

? **Systems that offer significant advances towards:**

- Sustainability
- Economics
- Safety and reliability
- Proliferation resistance and physical protection

? **Systems that are deployable by 2030 or earlier**





U.S.A. *United Kingdom* *Switzerland* *South Korea* *South Africa* *Japan* *France* *Canada* *Brazil* *Argentina*

Generation IV Nuclear Energy Systems:
Nuclear Power for a New Century

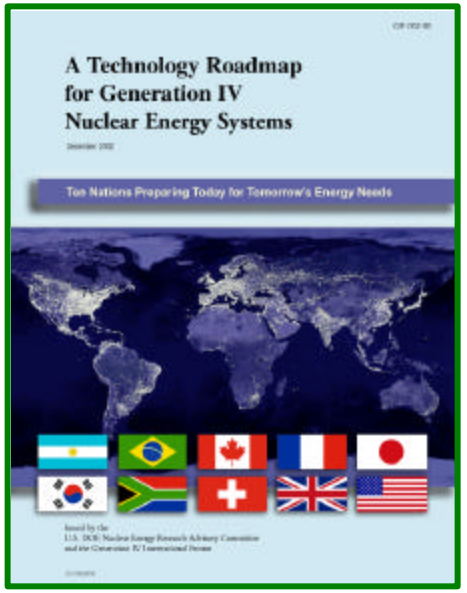
? **In September 2002, the Generation IV International Forum selected six system concepts for further development:**

- Very High Temperature Reactor
- Supercritical Water Cooled Reactor
- Gas Cooled Fast Reactor
- Lead Cooled Fast Reactor
- Sodium Cooled Fast Reactor
- Molten Salt Reactor

? **In December 2002, the Generation IV Technology Roadmap was issued**

- Summarizes and prioritizes the R&D activities necessary to develop the six system concepts

December 2002



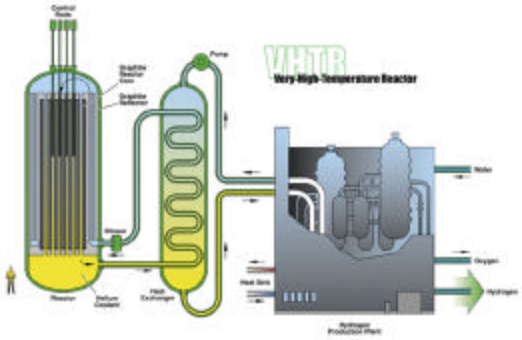
http://nuclear.gov/nerac/FinalRoadmapforNERACReview.pdf

A Long-Term Strategy for Nuclear Energy

Generation IV Nuclear Energy Systems

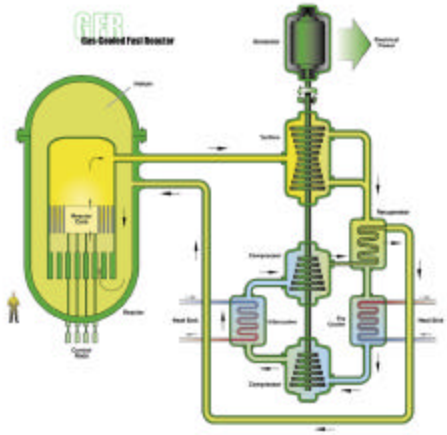
Generation IV Thermal Reactors -- Gen IV "A"

- ? Thermal neutron systems
- ? Advanced, high burnup fuels
- ? High efficiency, advanced energy products
- ? Available by 2020



Generation IV Fast Reactors -- Gen IV "B"

- ? Fast neutron systems
- ? Proliferation-resistant closed fuel cycles
- ? Minimize long-term stewardship burden
- ? Available by 2040



Generation IV Nuclear Energy Systems

Gen IV "A" Thermal Systems

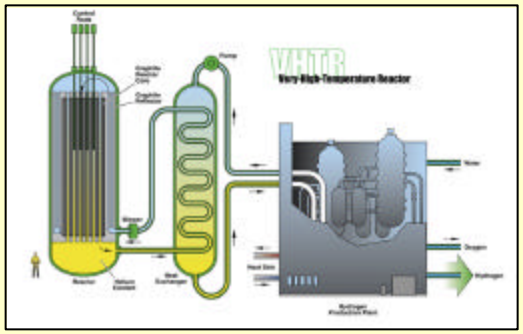
Next Generation Nuclear Plant

? Very High Temperature Reactor

- Thermal neutron spectrum and once-through cycle
- High-temperature process heat applications
- Coolant outlet temperature above 1,000°C
- Reference concept is 600 MWth with operating efficiency greater than 50 percent

? Advanced Energy Production

- High efficiency electricity generation
- High efficiency hydrogen production via thermochemical water cracking



Likely Partners:

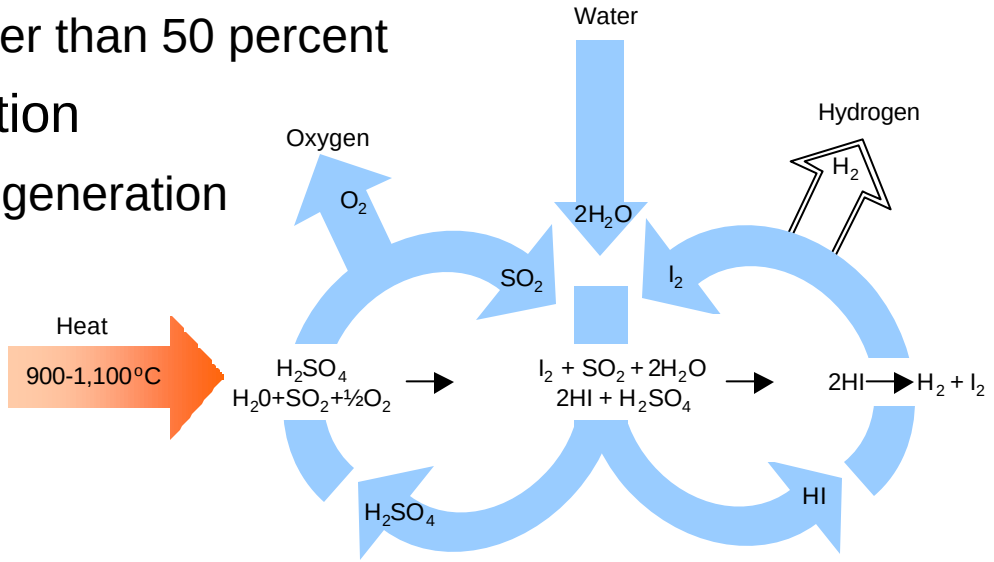

France


Japan


South Africa


South Korea


United Kingdom

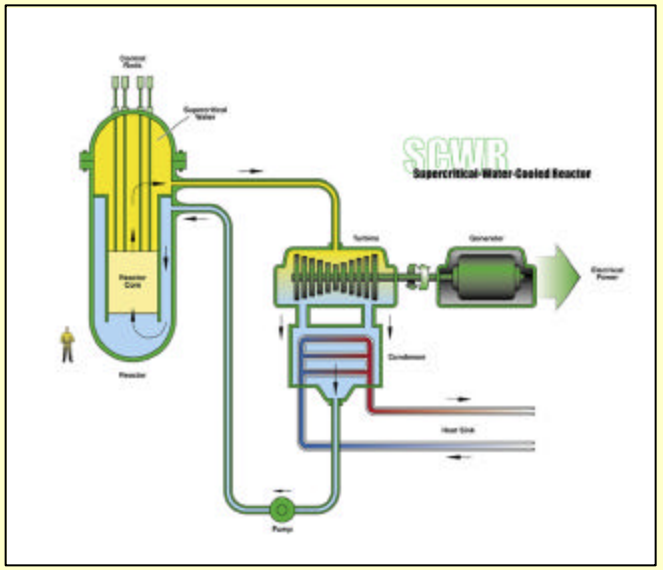


Generation IV Nuclear Energy Systems

Gen IV "A" Thermal Systems

Supercritical Water-Cooled Reactor

- Thermal neutron spectrum and once-through cycle
- High-temperature, high-pressure system
- Operates above thermodynamic critical point of water
- Coolant outlet temperature of 550°C
- Reference concept is 1,700 MW_e with operating efficiency greater than 40 percent



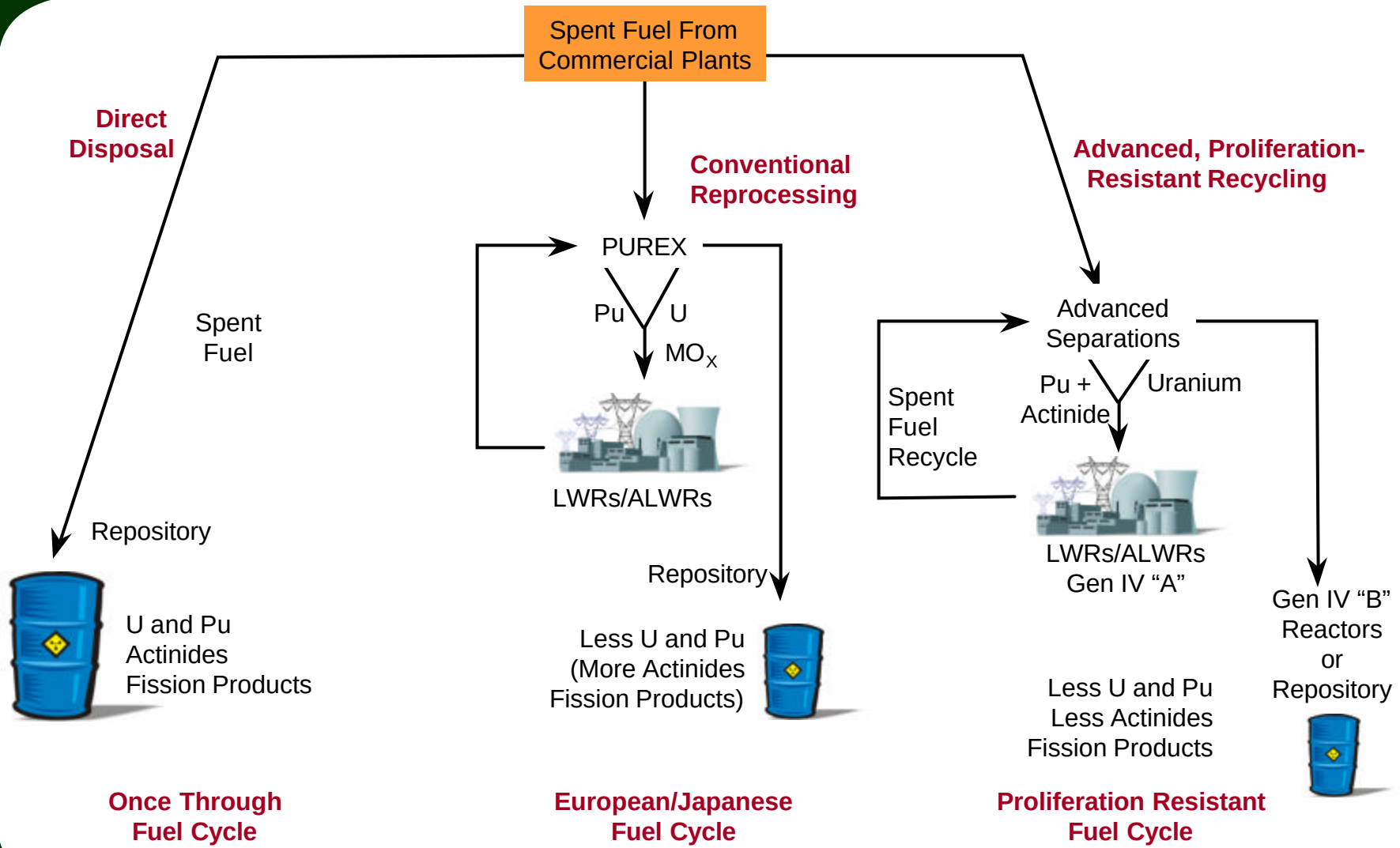
Likely Partners:


Canada


Japan


South Korea

Advanced Fuel Cycle Technologies:
Application to Thermal Reactors



INL's Role in Gen IV "A"

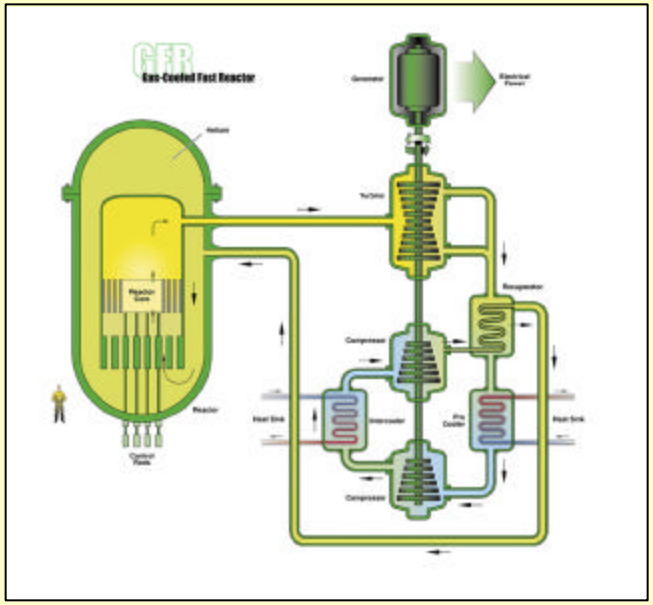
- **Lead development of critical technologies required for both reactor and fuel cycle systems**
- **Lead technical cooperation with other DOE labs, industry, and international community**
- **Assist in development of regulatory methods and requirements**
- **Support siting, construction, operation of demonstration reactors, and assume long-term ownership**
- **Complete demonstration of advanced fuel cycle technology for thermal reactors**

Generation IV Nuclear Energy Systems

Gen IV "B" Fast Systems

Gas-Cooled Fast Reactor

- Fast neutron spectrum and closed fuel cycle
- Efficient management of actinides and conversion of fertile uranium
- Potential pin- or plate-based fuel assemblies or prismatic blocks
- Reference concept 300-600 MW_e



Likely Partners:


France


Japan


South Korea

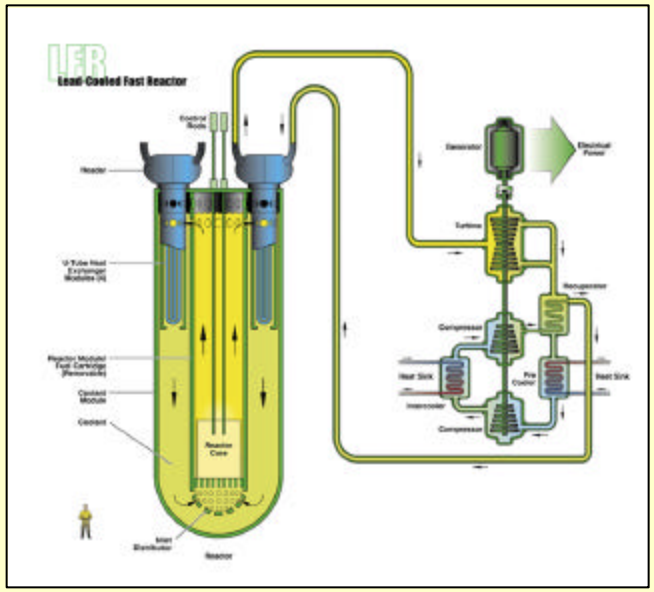

United Kingdom

Generation IV Nuclear Energy Systems

Gen IV "B" Fast Systems

Lead-Cooled Fast Reactor

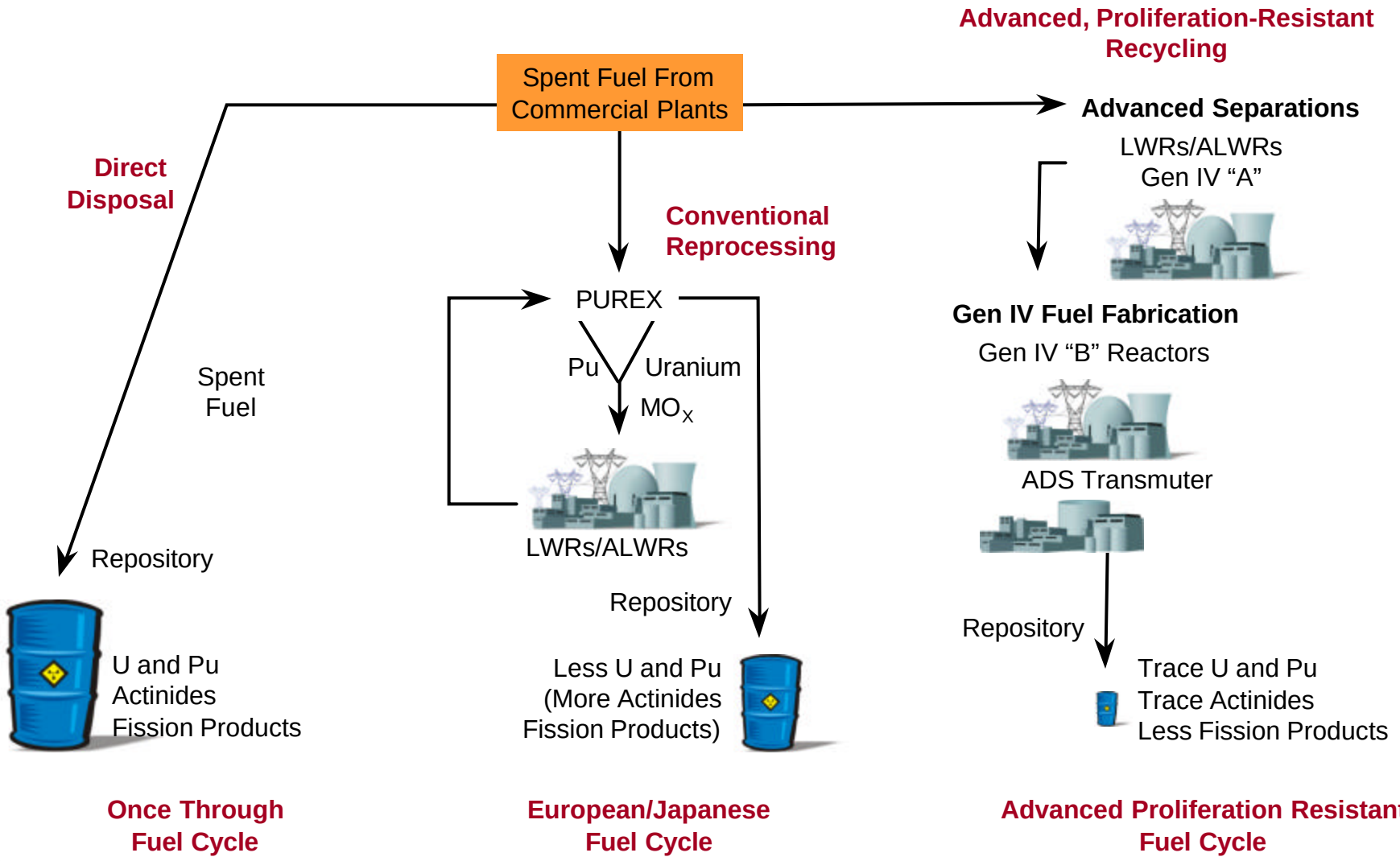
- Fast neutron spectrum and closed fuel cycle
- Efficient management of actinides and conversion of fertile uranium
- Proliferation-resistant, long-lived core
- Cooled by natural convection with outlet temperature of 600-800°C
- Reference concept 50-150 MW_e



Likely Partners:

Japan *South Korea* *Switzerland*

Advanced Fuel Cycle Technologies:
Application to Fast Reactors



INL's Role in Gen IV "B"

- **Lead development of critical technologies required for both reactor and fuel cycle systems**
- **Lead technical cooperation with other DOE labs and the international community**
- **Site, construct, and operate any required test facilities or demonstration systems**

Bottom Line

- DOE wants INL to be the top nuclear energy technology laboratory in the world within 10 years
- INL will need to work well with other labs, industry, universities, and the international community to accomplish its mission
- INL must also remain a strong multiprogram lab with special expertise in national security, homeland security, and vital areas of science and technology related to DOE's mission
- The key to success will be attracting and retaining talented, dedicated scientists and engineers who can make this mission a reality

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